

OpenFOAM Numerical Simulation of the Performance of the Oscillating Water Column Model WEC of the OES TASK 10 (Ocean Energy System – International Energy Agency)

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Oscillating Water Column (OWC) wave energy converters (WECs) have received considerable attention in the field of wave power generation due to their rather high reliability and simplicity. The performance of an OWC WEC is usually investigated by laboratory-scale experiments and field tests, but also, more and more by numerical simulation tools. However, there exist problems regarding the fidelity of these numerical tools, for example, whether the numerical models are accurate enough to reflect the nonlinear phenomena, and whether they can well handle sub-systems such as the Power-take-off (PTO) or the mooring systems. Therefore, it is important to carry out the validation and verification of the numerical models applied for OWC WEC simulation. Ocean Energy Systems (OES) is an Energy Technology Network program under the International Energy Agency (IEA). One of the tasks (Task 10) focuses on numerical modelling of wave energy systems, specifically, an OWC WEC, and investigates the issue of verification and validation of its numerical modelling. Different numerical models, including those based on potential flow theory, viscous flow theory, linear and nonlinear models are used within the OES Task 10. The results of these numerical models will be compared to discuss the fidelity level of each model.

Within the scope of the OES TASK 10, this abstract proposes to apply nonlinear numerical modelling based on the CFD package, OpenFOAM, in the simulation of the hydrodynamics and aerodynamics of the OWC WEC. The “olaFlow” toolbox will be employed for generating the waves and solving the multi-phase flow. The results will be compared with experimental data obtained from the Korean Research Institute of Ships and Ocean Engineering (KRISO) [1]. This work will contribute to the WECA Net Working Group 1.

References

[1] Sewan Park, Kyong-Hwan Kim, Bo-Woo Nam, Jeong-Seok Kim, Keyyong Hong, Experimental and numerical analysis of performance of oscillating water column wave energy converter applicable to breakwaters. In Proceedings of the 38th International Conference on Ocean, Offshore and Arctic Engineering, OMAE2019, Glasgow, Scotland, 9-14 June, 2019.

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